Eight Los Alamos projects win R&D 100 Awards

October 5, 2020

LOS ALAMOS, N.M., Oct. 5, 2020—Los Alamos National Laboratory technologies brought in eight R&D 100 Awards and Special Recognition Awards, including a Gold Award for Corporate Social Responsibility, Gold and Silver Awards for Market Disruptor - Services, and a Bronze Award for Green Technology, presented by *R&D World* magazine.

“Congratulations to the brilliant teams behind Los Alamos National Laboratory’s 8 R&D 100 awards,” said Laboratory Director Thom Mason. “These awards reflect the great work that our Laboratory does that can both benefit humanity and advance the frontiers of science.”

- **Amanzi-ATS** is an open-source software that includes the most complete suite of surface/subsurface physical processes to model complex environmental systems across multiple scales.
- **Cluster Integrity, Exception Resolution and Reclustering Algorithm (CIERRA)** is a software tool that analyzes massive amounts of satellite-collected lightning observations to provide the most comprehensive and accurate understanding of lightning data.
- **Legion**: a data-centric HPC programming system is an open-source software tool that boosts application performance and speed of computing by automating task scheduling and data movement.
- **Multi-Burn Solid Rocket** provides multiple independent thrusts from a single solid rocket to enable small satellites to maneuver, avoid debris, and de-orbit.
- **OrganiCam** is the first camera for noncontact, nondestructive biodetection in remote environments and space.
- **QUIC-Fire** software is the first laptop-capable, fast-running 3D fire-atmosphere feedback model for wildland fire management.
- **Smart Microbial Cell Technology** is an ultra-high-throughput screening platform to engineer custom biocatalysts that enhance the rate of chemical reactions critical in pharmaceuticals, renewable energy, and environmental cleanup.
- **Spectroscopic Detection of Nerve Agents (SEDONA)** is the only portable screener to accurately detect the chemical nerve agents in unopened bottles, providing results in seconds.

“I congratulate the R&D 100 Award teams. These diverse innovations exemplify the Laboratory’s tradition of scientific and engineering excellence in support of our national

security mission, industrial competitiveness, and the broader technical community," said John Sarrao, Deputy Laboratory Director for Science, Technology, and Engineering. "The awards demonstrate the strength of our partnerships with industry, academia, and other national laboratories in developing innovative solutions to challenging problems."

The R&D 100 Awards

The prestigious "Oscars of Invention" honor the latest and best innovations and identify the top technology products of the past year. The R&D 100 Awards span industry, academia and government-sponsored research organizations.

Since 1978 Los Alamos has won more than 170 R&D 100 Awards. The Laboratory's discoveries, developments, advancements and inventions make the world a better and safer place, bolster national security and enhance national competitiveness.

See all of the 2020 R&D 100 Awards. Read more about the Laboratory's past R&D 100 Awards.

Background about the winners

Amanzi-ATS

The open-source software models complex environmental systems across multiple scales. The innovation includes the most complete suite of surface/subsurface processes, built on a flexible infrastructure that allows users to select physical processes and their coupling interactions without rewriting software. Amanzi–ATS has been used to analyze pristine local watersheds, wildfire impact on watersheds, subsurface contaminant transport at legacy waste sites, the effect of a warming climate on the Arctic tundra, and groundwater in fractured porous media.

Los Alamos led the joint entry with Oak Ridge National Laboratory, Lawrence Berkeley National Laboratory, and Pacific National Laboratory. David Moulton directed the Los Alamos team of Adam Atchley, Charles Abolt, Joe Beisman, Katrina Bennett, Markus Berndt, Quan Bui, Michael Buksas, Neil Carlson, Dylan Harp, Rao Garimella, Vitaliy Gyrya, Eugene Kikinzon, Konstantin Lipnikov, Julien Loiseau, Daniel Livingston, Zhiming Lu, Terry Miller, John Ortiz, Alexis Perry, Lori Pritchett-Sheats, Daniil Svyatsky, Alec Thomas, Svetlana Tokareva plus researchers from the other collaborating national laboratories.

Cluster Integrity, Exception Resolution, and Reclustering Algorithm (CIERRA)

CIERRA is the first and only software that assesses massive amounts of data from real-time satellite lightning observation and reprocesses that data to ensure an accurate, comprehensive interpretation of the lightning flashes. This enables observation and analysis of previously unstudied, complex cases of extreme and exceptional lightning and provides situational awareness of lightning hazards.

Michael Peterson teamed with Scott Rudlosky (University of Maryland). CIERRA also received a Gold Special Recognition Award for Market Disruptor-Services, which highlights any service from any category as one that forever changed the R&D industry or a particular vertical within the industry.

Legion: A data-centric programming system

Legion is a supercomputing programming system that boosts application performance and speed by automating task scheduling and data movement. The open-source software employs a novel programming language, Regent, which is compatible with all supercomputing architectures. Legion reduces the effort required to write supercomputing applications, eliminating the bottleneck to next-generation exascale computing and enabling the highest levels of performance. Legion is now being applied in computational science, machine learning, and data-centric computing.

Los Alamos led the joint entry with Stanford University, NVIDIA, Sandia National Laboratories, University of California-Davis, and SLAC National Accelerator Laboratory. Galen Shipman and Patrick McCormick directed the Los Alamos research team of Jonathan Graham, Irina Demeshko, Nirmal Prajapati, and Wei Wu.

Multi-Burn Solid Rocket

Solid rockets are high thrust, safe, scalable, and can be stored for long periods. However, they traditionally only provide a single burn per motor. The Multi-burn Solid Rocket is a revolutionary system providing multiple independent thrusts from a single solid rocket. This new capability could provide agile maneuverability for even the smallest and lowest cost satellites. The Earth's orbital zones are an important natural resource. The Multi-burn Solid Rocket could help protect this resource by enabling satellites to avoid orbital debris and to de-orbit at the end of life.

Nicholas Dallmann, Bryce Tappan, and Mahlon Wilson led the team of Eva Baca, Malakai Coblentz, Kavitha Chintam, Bo Folks, Dave Hemsing, Mitchell Hoffmann, Lee Holguin, Joseph Lichthardt, Alan Novak, Kassidy Shedd, Ian Shelburne, Jacob Valdez.

OrganiCam

OrganiCam opens exciting frontiers in space exploration and the search for signs of life beyond the Earth. The compact laser-induced fluorescence imaging camera with Raman spectrometer could identify organic molecules and biosignatures in Martian caves, icy-moons, and asteroid surfaces. OrganiCam's robust design for extreme environments, portability, simple operation, and low power requirement build on the Lab's 50+ years designing robotic instruments for space applications.

Los Alamos led the joint entry with University of Hawai'i. Roger Wiens and Patrick Gasda directed the Los Alamos team of Samuel Clegg, Magdalena Dale, Kumkum Ganguly, Steven Love, Anthony Nelson, Adriana Reyes-Newell, Raymond Newell, Logan Ott, Benigno Sandoval, and Heather Quinn. Anupam Misrad led a team of collaborators from the University of Hawai'i.

QUIC-Fire

The software is the first fast-running, laptop-capable, 3D fire-atmosphere feedback model for complex wildfire and prescribed fire scenarios. It simulates critical influences of 3D vegetation structure, variable winds, interaction between multiple fires, and complex topography at meter-scale spatial resolutions. QUIC-Fire transforms fire and fuel manager's ability to assess risk, optimize fuel treatments, and plan prescribed burns to prevent catastrophic wildfires.

Rodman Linn of Los Alamos, Scott Goodrick of the USDA Forest Service, and J. Kevin Hiers of Tall Timbers Research Station led the team of Los Alamos researchers Sara Brambilla, Michael Brown, Alexandra Jonko, Alexander Josephson, Richard Middleton, and David Robinson plus collaborators from the USDA Forest Service.

In addition to the R&D 100 Award, Quick-Fire won a Gold Medal in the Corporate Social Responsibility Category. This award honors organizational efforts to be a greater corporate member of society, from a local to global level.

Smart Microbial Cell Technology

Biocatalysts are essential for food production, pharmaceuticals, specialty chemicals, renewable energy, and environmental cleanup. Current methods to find biocatalysts are slow. Smart Microbial Cell Technology scans genetic variations to optimize a single enzyme or microbial cell to generate a product efficiently. It selects rare mutations needed for biocatalyst optimization orders of magnitude faster than current screening methods. A custom sensor reporter gene circuit causes cells to fluoresce when they are making the target product. When coupled to flow cytometry, a million biocatalyst variants can be screened in hours.

Ramesh Jha led the team of Taraka Dale and Charlie Strauss.

Smart Microbial Cell Technology also received a Silver Special Recognition Award for Market Disruptor-Services, which highlights any service from any category as one that forever changed the R&D industry or a particular vertical within the industry.

Spectroscopic Detection of Nerve Agents (SEDONA)

Current airport detection system cannot scan for the threat of toxic organophosphorus nerve agents and insecticides. The SEDONA portable system screens *through* an unopened bottle using the principles of nuclear magnetic resonance spectroscopy. The system could be deployed and operated with minimal training. SEDONA dramatically reduces the likelihood of a successful nerve agent attack at airports, government buildings, embassies, sporting events, concerts, and political rallies.

Robert F. Williams led the team of Michelle Espy, Jacob Yoder, Derrick Kaseman, Per Magnelind, Algis Urbaitis, Michael Janicke, Ryszard Michalczyk, Jurgen Schmidt, Pulak Nath, and Scarlett Widgeon Paisner.

Additional Recognition

The Laboratory also received a Bronze Medal for Green Technology. The awards recognize those innovations that help make our environment greener and our goal towards energy reduction closer.

Oleo-Furan Surfactants Made from Renewable Biomass

Oleo-furan surfactants (OFS) is a new class of non-toxic, non-irritating cleaning agents (surfactants) for laundry detergent. It is the only surfactant that performs effectively in cold water and in hard water, without additional chemicals that other detergents must use to bind the minerals in hard water. OFS can be produced readily from sustainable, bioderived molecules that don’t tax the environment or compete with the food supply chain.

Andrew Sutton of Los Alamos National Laboratory led the Los Alamos team of Cameron Moore and Xiao (Claire) Yang. Christoph Krumm of Sironix Renewables led collaborators from Sironix.

Separately, one Laboratory team also received a R&D 100 Finalist Award:

Electrochemical Hydrogen Contamination Detector protects zero-emission fuel cells by detecting the presence of impurities in hydrogen fuel. Fuel cells power

environmentally clean vehicles, forklifts, drones, and provide auxiliary power. High-purity hydrogen is essential to avoid poisoning fuel cells. Current analysis methods are costly and cannot detect impurities in real-time. The Hydrogen Contamination Detector measures some of the highest impact Department of Energy-identified impurities with a simple, low-cost unit that provides 24/7, point-of-service analysis.

Eric Brosha led the team of Christopher Romero, Mahlon Wilson, Rangachary Mukundan, Cortney Kreller, and Tommy Rockward plus collaborators from H2 Frontier, Inc and Skyre, Inc.

Read more about the Laboratory's past R&D 100 Awards.